REMARKS

In view of the foregoing amendment and following remarks, reconsideration of this application and early allowance of the application is respectfully requested.

Claim 1 stands finally rejected under 35 U.S.C. § 103(a) as being obvious over Kunze U.S. Patent No. 4,047,283 in view of Schneider U.S. Patent No. 4,377,323 and Hensel U.S. Patent No. 4,102,717. Claim 1 has been amended to more particularly point out and distinctly claim Applicants' invention. No new matter has been introduced.

Applicants respectfully traverse the Examiner's rejection of claim 1 under 35 U.S.C. §103(a) as being obvious over Kunze in view of Schneider and Hensel for the reasons detailed below. Significant differences exist between Applicants' claimed invention and the Kunze, Schneider and Hensel patents which prevent these patents, whether taken alone or in combination, from disclosing, yielding or even suggesting Applicants' claimed invention.

As set forth in detail in the present application, Applicants' invention is directed to embodiments of a new optical fiber splicer and associated splicing method. The inventive optical fiber splicer includes abutment and pressure-contact means (and a drive mechanism) which can slide terminal portions of retained optical fibers to be spliced in mutually opposite directions along a V-shaped groove formed in a block of the splicer. Substantially equal elastic forces can thereby be produced in the terminal portions of the fibers, bringing the terminal portions into abutment and pressure contact.

The abutment and pressure-contact means include a slide member having one end fixed to the underside of the block and the other end including a laterally extending arm. A shaft having a dial operable for raising and lowering the block and an eccentric cam coaxially fixed on the shaft and axially supported by a base are provided. Tension springs, connected between the

arm of the slide member and the base, energize the slide member toward the eccentric cam. When the dial is rotated, the rotation is transmitted through the shaft to the eccentric cam causing progressive movement of the slide member under the force of the tension springs. The block, which is attached to the slide member, thereby can be moved toward the terminal portions of the optical fibers to be spliced.

The amount of elongation of the tension springs can be set to prevent breakage of the optical fibers by pressure contact forces that exceed the stress tolerance of the fibers. Thus, the tension springs can function as a pressure limiting mechanism and will hold the block if the eccentric cam should be rotated to a point beyond the set amount of elongation of the tension springs. Accordingly, the risk of accidental breakage of the fibers is substantially reduced.

The optical fiber splicer according to the present invention also includes an adjustable stop for fine adjustment of the position of the base. Although the set amount of the elongation of the tension springs may change over time or be influenced by repeated use, fine adjustment of the position of the base using the adjustable stop can further prevent the undesired formation of a gap between the centers of the terminal portion of each of the optical fibers being spliced, allowing for a highly accurate connection.

Thus, the optical fiber splicer according to the present invention enables optical fibers to be spliced with high precision, i.e., with substantially no offset between the centers of their terminal portions, without the need for connector or matching oil or the like.

Applicants have amended claim 1 to more particularly point out and distinctly claim the foregoing arrangement. Particularly, claim 1 now affirmatively recites an adjustable stop for fine adjustment of the position of the base. Further, claim 1 now recites affirmatively

that the tension springs hold the block if the eccentric cam is rotated beyond the set amount of elongation of the tension springs.

As now explained, a review and reading of the Kunze, Schneider and Hensel patents makes clear that these patents, whether taken alone or in combination, do not yield, teach or even suggest Applicants' optical fiber splicer apparatus as now claimed.

As acknowledged by the Examiner, the Kunze patent, which describes a method and apparatus for splicing light waveguides, does not disclose abutment and pressure-contact means for sliding the terminal portions of the fibers to be spliced in mutually opposite directions with substantially equal elastic forces to bring the terminal portions into abutment and pressure contact as affirmatively and clearly recited in claim 1 of the present application. Moreover, Kunze does not teach or suggest the use of tension springs as a pressure limiting mechanism as clearly indicated in claim 1; nor does Kunze disclose the adjustable stop for fine adjustment of the position of the base as affirmatively recited in claim 1 as now amended. Accordingly, Kunze does not teach or suggest Applicants' apparatus as claimed in the present application.

Schneider and Hensel do not overcome the severe deficiencies of Kunze. The combination of Schneider and Hensel with Kunze does not yield, teach or suggest the present invention as now claimed.

Schneider, which describes a device for splicing light waveguides, is particularly concerned with improving the support structure for the axles of the waveguide holding devices and providing means for controlling the movement of the axles (col. 2, lines 42-47) to control the spacing between the axles. The axles of the holding devices are displaceable toward or away from one another with the assistance of a ball bearing support. To control axle movement and spacing, cam links are provided supported adjacent to a conventional vertically movable support

for supporting a conventional splicing element having a centering groove. An arm is secured to each holding device and includes a cam follower engaged with the respective cam link.

This is not the abutment and pressure-contact structure of the present invention as affirmatively recited in claim 1 of the present application. Particularly, Schneider does not teach or suggest abutment and pressure-contact means including a slide member having an end fixed to the undersurface of the splicing element or block and another end having a laterally extending arm, a shaft provided with means for adjusting the vertical position of the block and an eccentric cam coaxially fixed on the shaft, a base for axially supporting the eccentric cam, and tension springs connecting the arm of the slide member and the base for energizing the slide member toward the eccentric cam, the tension springs acting as a pressure limiting mechanism to prevent breakage of the fibers by pressure contact forces that exceed the stress tolerance of the fibers, the tension springs holding the block if the eccentric cam should be rotated to a point beyond the set amount of spring elongation. Nor does Schneider disclose an adjustable stop for fine tuning the position of the base as clearly claimed in amended claim 1.

Hensel describes a device and method for effecting an optical coupling between two light waveguides. In the Hensel device, optical waveguides to be spliced are positioned in a grooved plate by means of a pair of inclined ramps mounted on a casing. Magnetic pads hold the optical waveguides in grooves in the inclined ramps. Needle assemblies which slide freely through holes in the inclined ramps are used to preliminarily position the optical waveguides in the grooves. One inclined ramp is rigidly attached to the device casing while the other ramp is moveable toward the inclined ramp. The moveable ramp is rigidly attached to a differential screw mechanism which enables the ramp to be moved with a course adjustment and a fine adjustment. A vertically moveable (by means of knob which rotates a shaft to which a cam is

attached) central column supports the grooved plate. The central column is mounted on a platform having three vertical rods passing through it. The column assembly is biased to a lowest position by means of springs surrounding each of the vertical rods. A photodiode housed in a photodiode housing hinged to the top of the central column monitors the condition of the splice joint.

In operation of the Hensel device, one optical waveguide is moved toward the other by moving the moveable ramp with the aid of the differential screw. When light radiated from the end of one optical waveguide reaches a minimum value, this indicates alignment, and the waveguides are fixed relative to each other. The grooved plate is heated by a heater. Epoxy resin is placed over the optical waveguides, which when heated, sets to form a permanent joint. Slight gaps which occur between the ends of the optical waveguides are filled with the epoxy resin.

Hensel does not teach or suggest the arrangement according to the present invention and the features affirmatively recited in claim 1 as amended. Particularly, Hensel does not teach or suggest the use of tension springs to serve as a pressure limiting mechanism to prevent breakage of the fibers. According to Hensel (col. 4, lines 47-52), the springs surrounding the vertical rods of the column assembly are pressure-contact or compression springs whereby rotation of the cam from its lowest position changes the position of the platform. In contrast, according to the present invention as claimed in amended claim 1, rotation of the eccentric cam to a point beyond the set amount of elongation of the tension springs does not result in a change in the position of the slide member and the block is held in position to prevent breakage of the fibers.

Furthermore, although Hensel describes the use of a knob for fine adjustment of one of the inclined ramps, Hensel does not disclose or suggest means for adjusting the position of the base as recited in claim 1 of the present application. Rather, Hensel teaches using the knob to move the moveable inclined ramp progressively closer to the rigidly fixed ramp. As a result, the elastic forces produced in the terminal portions are not substantially equal and the use of a retaining member and epoxy resin is required to minimize/fill the undesired gap formed between the abutting faces of the fibers. In stark contrast, the present claimed invention overcomes this disadvantage associated with the Hensel device by providing for fine adjustment of the block to enable splicing with substantially equal elastic forces and with substantially no offset between the centers of the fibers.

In view of the foregoing, it is respectfully submitted that one of ordinary skill in the art who reads and understands Kunze, Schneider and Hensel would not be inclined, let alone equipped, to arrive at the present invention as claimed in claim 1 as now amended. Accordingly, Applicants submit that claim 1 is patentable over the cited references, whether taken alone or combined. Notice to this effect is respectfully solicited.

On the basis of the foregoing amendments and remarks, which constitute a bona fide attempt to advance the application (37 CFR 1.111), Applicants respectfully submit that this application is in condition for immediate allowance, and notice to this effect is earnestly requested. The Examiner is invited to contact Applicants' undersigned attorneys at the telephone number set forth below if it will advance the prosecution of this case.

A check in the amount of $430.00 is enclosed covering the $375.00 fee for the RCE filed herewith and the $55.00 fee for the Petition for a One-Month Extension of Time

submitted herewith, all at the small entity rate. No other fees are believed due with this Response.

Please charge any fee deficiency or credit any overpayment to the undersigned attorneys' Deposit Account No. 50-0540.

Respectfully submitted,

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